UNITED ARAB EMIRATES
MINISTRY OF CLIMATE CHANGE
& ENVIRONMENT

National Climate Change Adaptation Program

UAE Climate Risk Assessment & Adaptation Measures in Key Sectors

Health, Energy, Infrastructure & Environment

2019

www.moccae.gov.ae

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Foreword

In September of 2017, we launched the National Climate Change Adaptation Program during the UAE Government Annual Meetings. The Program aims to assess the impacts of climate change on key sectors and identify the climate risks that demand urgent action. By doing this, we strive to make the UAE one of the most climate-resilient countries in the world.

To identify the most effective adaptation measures for the UAE, the Ministry of Climate Change and Environment conducted risk assessment on four priority sectors: health, energy, infrastructure, and environment, based on review of available research, participatory stakeholder consultation, and expert inputs.

Our analysis reveals that the UAE is indeed facing climate risks, which if left unattended, can pose development challenges. Nevertheless, resilience has been embedded in the UAE's history and culture as proven by our ability to cope with and overcome the harsh desert environment for centuries. It is also worth noting that the UAE is already implementing a wide range of adaptation measures in different sectors, which put us in a good position, but further innovative ideas and action would be required to further transform climate challenges into opportunities.

Looking ahead, the completion of the risk assessment only marks the start of our continuous effort to pursue adaptation at all levels of society. Since risk assessment is an iterative process, we will update our analysis based on available new information. We will also work with our partners to make quality data and research more available to help us better understand the climate risks.

I hope that this report serves as an inspiration for more action by all of us; whether in government, companies, schools, universities, or households. Our success lies in the active engagement of all stakeholders, to whom I extend my sincere appreciation for their valuable contribution and I look forward to our stronger collaboration in the coming years.

H.E. Dr. Thani Bin Ahmed Al Zeyoudi

Minister of Climate Change
& Environment

Acknowledgements

This report was developed by the United Arab Emirates' Ministry of Climate Change and Environment (MOCCAE), with technical support from the Global Green Growth Institute (GGGI). It was developed based on international benchmarking, sectoral background papers, publically available data and research, and a series of group and bilateral consultation meetings with experts and representatives from the government, private sector, and academic institutes as indicated below. Their contributions are greatly acknowledged.

FEDERAL GOVERNMENT
Ministry of Economy
Ministry of Energy and Industry
Ministry of Finance
Ministry of Health and Prevention
Ministry of Infrastructure Development
Prime Minister's Office
Emirates Authority for Standardization & Metrology
Federal Electricity and Water Authority
Federal Transport Authority
General Authority of Ports, Borders and Free Zones Security
General Civil Aviation Authority
National Center of Meteorology
National Emergency Crisis & Disasters Management Authority

LOCAL GOVERNMENT
Department of Energy - Abu Dhabi
Department of Health - Abu Dhabi
Department of Transport - Abu Dhabi
Department of Urban Planning and Municipalities - Abu Dhabi
Environment Agency – Abu Dhabi
Dubai Airports
Dubai Electricity and Water Authority
Dubai Health Authority
Dubai Municipality
Dubai RSB
Road and Transport Authority - Dubai
Supreme Council of Energy - Dubai
Environment & Protected Areas Authority - Sharjah
Sharjah Airport Authority
Sharjah Electricity and Water Authority
Sharjah Municipal Affairs, Agriculture & Livestock Department
Sharjah Municipality
Urban Planing Council – Sharjah
Environmental Protection and Development Authority – Ras Al Khaimah
Public Works & Services Department - Ras Al Khaimah
Ras Al Khaimah Municipality
Waste Management Authority - Ras Al Khaimah
Fujairah Municipality
Ajman Municipality and Planning Department
Umm Al Quwain Municipality
Dibba Municipality

PRIVATE SECTOR
ADNOC
Arup
Dnata Group
Dubai Carbon
Emirates Airline
Enerwhere
Engie
ENOC
Etihad Energy Services
First Abu Dhabi Bank
Mott MacDonald

ACADEMIC INSTITUTIONS
American University Dubai
American University of Ras Al Khaimah
American University of Sharjah
Khalifa University of Science and Technology
Mohammed Bin Rashid School of Government
Mohammed Bin Rashid University
New York University Abu Dhabi
Sharjah University
United Arab Emirates University
Zayed University

OTHER
Abu Dhabi Global Environmental Data Initiative
Emirates Nature - WWF

This document is a synthesis of the UAE's climate risk assessment conducted in its four key sectors – health, energy, infrastructure, and the environment – as the first step to implement the National Climate Change Adaptation Program. For the details on each sector's assessment results and methodology, the following documents are available from: *www.moccae.gov.ae.*

UAE Sectoral Climate Risk Assessment Framework
Adaptation of the UAE's Public Health to Climate Change
Adaptation of the UAE's Energy Sector to Climate Change
Adaptation of the UAE's Infrastructure to Climate Change
Adaptation of the UAE's Environment to Climate Change

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Overview

Despite collective global efforts, greenhouse gas emissions continue to rise, causing significant threats to all sectors of our society. Timely and effective measures to adapt to climate change is now more important than ever.

While the UAE is well adapted to its harsh desert conditions and has remarkably prospered in spite of its climate, future climate change may impose **new and overwhelming pressures** on the country's environment, economy, and society.

Climate projections for the UAE and the Gulf region reveal **increased** temperature and humidity levels, **longer** hot and humid seasons, **more intense** rainfall, **higher** seawater levels, and **increased likelihood and scale** of extreme weather events.

The UAE government launched the ***National Climate Change Plan 2050*** in 2017, a policy framework enabling the transition toward a climate-resilient green economy, while managing greenhouse gas (GHG) emissions, minimizing climate risks, and increasing adaptation capabilities.

As the first step in implementing the Plan, the **National Climate Change Adaptation Program** was launched with the aim to make the UAE one of the most climate-resilient countries in the world. Subsequently, the Ministry of Climate Change and Environment (MOCCAE) conducted **a comprehensive assessment of potential climate risks** to the country.

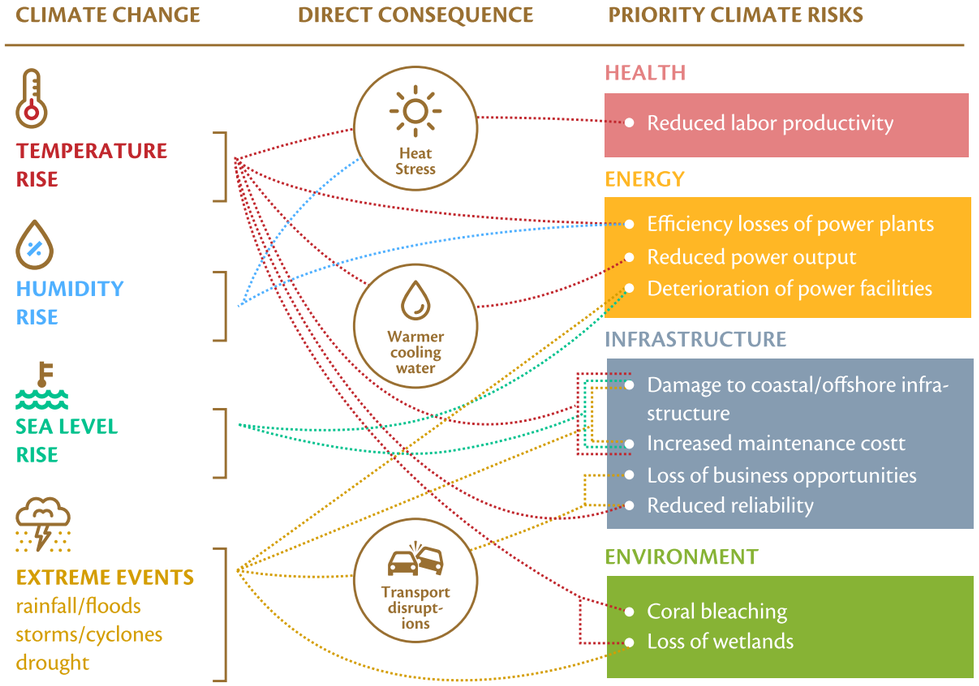
The climate risk assessment considered how climate change phenomena could affect **four key sectors** – human health, energy (electricity and heat), infrastructure, and the environment. **Ten priority climate risks** (shown in the figure below) were identified which were rated very high or high according to the risk assessment framework developed for this analysis.

In designing adaptation measures to increase the priority climate risks, a range of **existing initiatives** that could be enhanced or refocused to increase climate resilience are identified in this report. **New policies and actions** are also proposed where relevant measures are missing or insufficient to address and manage the risks.

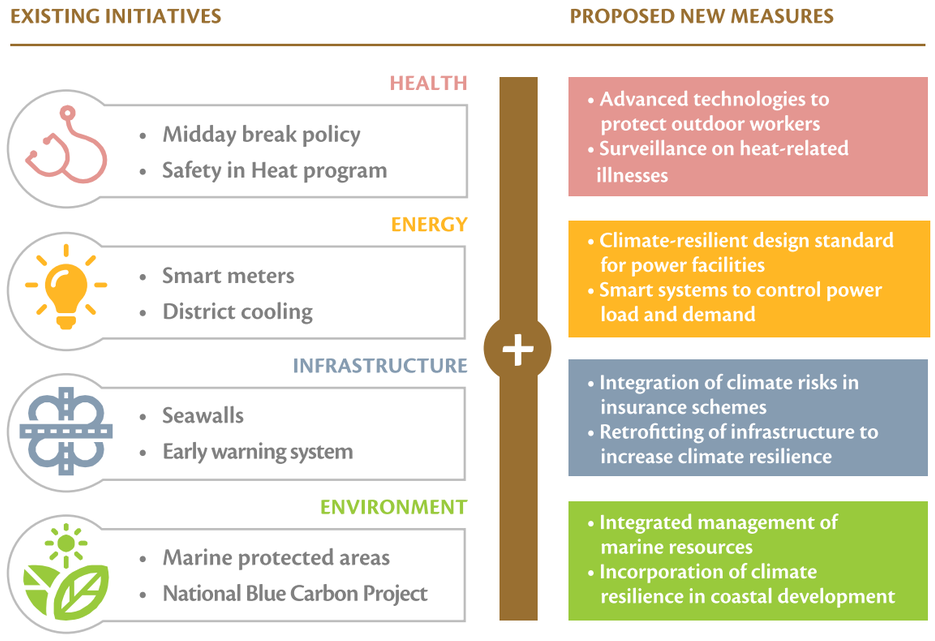
The proposed adaptation measures will need to be **further analyzed, prioritized, and implemented** by relevant national and local entities as well as stakeholders in the subsequent phase of the National Climate Change Adaptation Program. Examples of existing and potential new measures are shown in the figure below.

In the long term, climate change adaptation should be mainstreamed into national development planning and sectoral strategies. Equally important would be to improve climate science to gain more region-specific risk information.

The success of climate change adaptation depends on the **active engagement** of all relevant stakeholders to work together toward a common goal of strengthening resilience and **transforming climate risks into opportunities.**



10 priority climate risks for the UAE



Examples of existing and potential new measures for climate adaptation

1. How will climate change affect the UAE?

Current trends & future projections

The UAE lies in a region known for its water scarcity and intense heat. While people in the UAE have been able to survive and even thrive under these conditions, climate change will very likely exacerbate the already extreme conditions. Temperatures, humidity levels, seawater levels, rainfall, and extreme events like tropical cyclones will all change and pose significant yet uncertain risks to our economy, environment, and society if left unchecked. The table below summarizes the current trends and the future projections for the UAE in a climate change scenario.

	TEMPERATURE	HUMIDITY	SEA LEVEL RISE	RAINFALL	EXTREME EVENTS
What is happening?	Temperature in summer months rises to about **48˚C** in coastal cities – even **50°C** in the desert regions.	Average humidity is **50-60%** in coastal areas; **45%** in inland areas. Extreme humidity reaches as high as **90%**.	Average sea level rise over the past decades in the Arabian Gulf is **0.18-0.23 cm** per year.	Annual rainfall is around **100 mm**.	**3 super cyclones** hit the Arabian Peninsula in 40 years. (1977-2018)
What could happen?	**2-3°C** average increase during the summer months by 2060-79	Humidity will increase about **10%** over the Arabian Gulf.	Coastal areas will experience **increasing mean high tides**.	More **intense rainfall**, particularly in Northern Emirates and Dubai.	More **frequent and severe** extreme events Growing risk of **high-impact storms**

Current trends and future projections for the UAE in a climate change scenario

Sources: Abu Dhabi Global Environmental Data Initiative (AGEDI)

What does a 2-3°C increase mean for the UAE?

The Paris Agreement on climate change adopted in 2015 set the specific goal of holding global warming to well below 2 degrees Celsius (°C) by the end of the century compared to pre-industrial levels, and of pursuing efforts to limit warming to 1.5°C. The UN Environment's *Emissions Gap Report 2018*, however, estimates that even if all actions pledged in the Nationally Determined Contributions (NDCs) of all countries that ratified the Agreement were implemented, the global average temperature could rise by 3°C, a much warmer world than desired.

So, how will an increase of 2-3°C affect the UAE? Although such an increase may seem small, its consequences can be quite unsettling. It could lead to an increasing number of extremely hot and humid days and that, for example, may increase demand for space cooling which would result in rising utility bills. The country will also have to prepare for more extreme weather events, including storms, cyclones, floods, heat waves, and sand and dust storms (see the next page). Further harmful impacts on human health and threats to biodiversity may be imminent. More intense rainfall could impose pressure on the existing infrastructure.

Extreme climate events in the UAE

Several extreme weather events have been observed in the UAE in the past few years:

High temperature & humidity

The UAE National Centre of Meteorology (NCM) recorded the highest temperature of 2018 at 51.5°C in Mezeira, Abu Dhabi on 11 July.

Outdoor workers are the most vulnerable to heat-related illnesses. For example, it was reported that 13 workers in Umm Al Quwain were rushed to the hospital due to heat exhaustion between May and July 2018. Heat exhaustion could lead to heat stroke which, if not treated properly, could cause death.

Floods

The UAE's arid areas barely receive rainfall, but the country is increasingly experiencing floods due to unusually intense rainfall. In December 2017, for example, heavy rain caused 581 accidents in Dubai, prompting 12,537 emergency calls.

In the mountainous areas of the Northern Emirates, heavy rains and thunderstorms, even though lasting very short, are causing flash floods, waterlogging, and overflow of wadis (dry riverbeds), leading to road blockages and casualties.

Sand & dust storms

Sand and dust storms occur frequently in the UAE owing to its desert environment. They obscure the skyline and severely reduce visibility, causing traffic disruptions and accidents. They also cause breathing difficulties, allergic reactions, etc.

2. What is the UAE's approach to climate change?

Paris Agreement & the UAE's pledge

The UAE was one of the first countries in the region that ratified the Paris Agreement. The Agreement commits more than 180 countries to pursue efforts to mitigate greenhouse gas (GHG) emissions and adapt to prospective climate change. To help attain the global goal, the UAE pledged 24% of its energy mix coming from clean energy by 2021, which was later increased to 27%, in support of its Nationally Determined Contribution (NDC).

To fulfill this commitment, the UAE has established a national policy framework in line with its proactive role in the international climate diplomacy. The UAE considers the transition to a climate-resilient green economy as a promising opportunity for economic diversification, while positioning the country as a global leader in renewable energy and green innovation.

National Climate Plan

The ***National Climate Change Plan 2050*** (*"Climate Plan"*) was adopted by the UAE Cabinet in June 2017 with the aim to consolidate the UAE's climate action under a single framework and to identify the strategic priorities, which cover both mitigation and adaptation.

The *Climate Plan* structures action areas according to three pillars: (1) GHG emissions management; (2) climate change adaptation; and (3) private sector-driven innovative economic diversification. In the second pillar of adaptation, it outlines the development of a nationally-coordinated policy with the following expected outcomes and timeline:

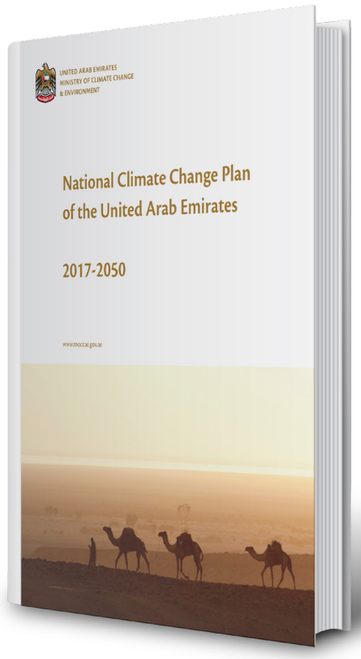
- By 2020: Climate change risk assessments are performed, and immediate measures are put in place;
- By 2025: Adaptation planning is mainstreamed in development policy; and
- 2030-2050: Continuous monitoring and evaluation is conducted to ensure evidence-based adaptation measures.

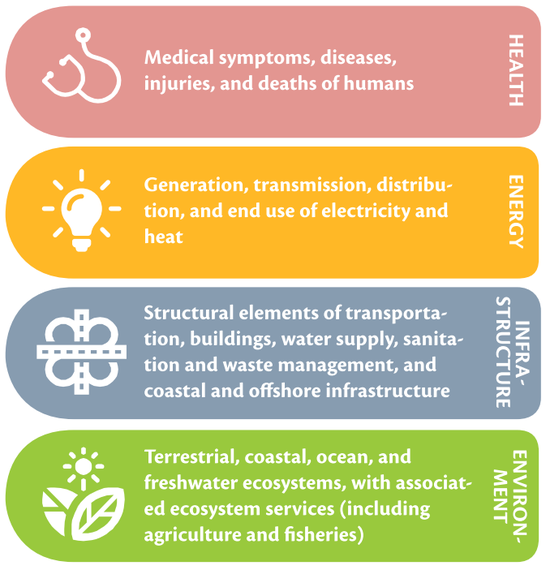
National Adaptation Program

To fulfill the *Climate Plan*'s first-phase requirement of the adaptation pillar, the Ministry of Climate Change and Environment (MOCCAE) launched the **National Climate Change Adaptation Program** in late 2017 with three main objectives:

1. Identify climate trends and assess impacts
2. Identify climate risks that demand urgent action
3. Involve all stakeholder groups in implementation

The Program primarily focuses on the risk assessment of and policy development for the four key sectors which are considered to be most important to ensure climate resilience in the country. More sectors may be covered in the future.



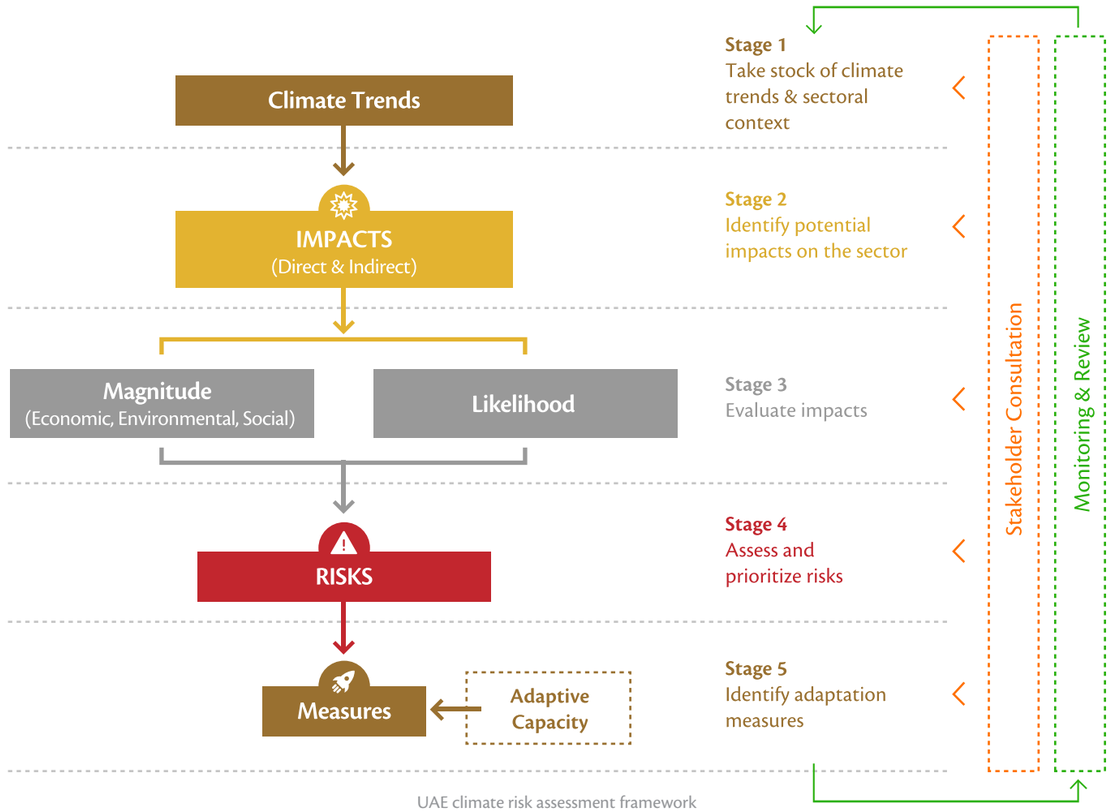


Scope of the UAE's 4 key sectors covered in climate risk assessment

3. What are the priority climate risks to the UAE?

Risk assessment process

To systematically analyze the climate change risks to the key sectors, MOCCAE developed a climate risk assessment framework. The framework incorporates local and global best practices, including the risk assessment framework developed by the National Crisis, Emergency and Disaster Management Authority (NCEMA). The risks are evaluated based on the magnitude of the economic, social, and environmental impacts and their likelihood of occurrence. The figure below summarizes the risk assessment process.



UAE climate risk assessment framework

To assess the risks, the list of potential climate change impacts on the health, energy, infrastructure, and environment sectors was firstly compiled from notable recent reports by the Intergovernmental Panel on Climate Change (IPCC), the World Health Organization (WHO), the International Energy Agency (IEA), and the UN Environment. The list was then examined against the country's specific context including the natural environment, demographics, and economic and social development. The shortlisted impacts were evaluated against their potential magnitude and likelihood, and were classified according to five levels of risk.

Given the limited availability of the research and data specific to the UAE and the wider region, the risk assessment was complemented by information and insights from local experts through surveys, interviews, and multi-stakeholder workshops. This process helped to make the assessment more inclusive and robust, and created the grounds for collective implementation of the required adaptation measures in the future.

Priority risks for the UAE

Going through the above risk assessment exercise for the four key sectors, the climate change impacts with the two highest risk levels ("very high" and "high") were identified as priority climate risks that would require the UAE to take action for adaptation in the next 3-5 years. The priority risks are explained in the figure below.

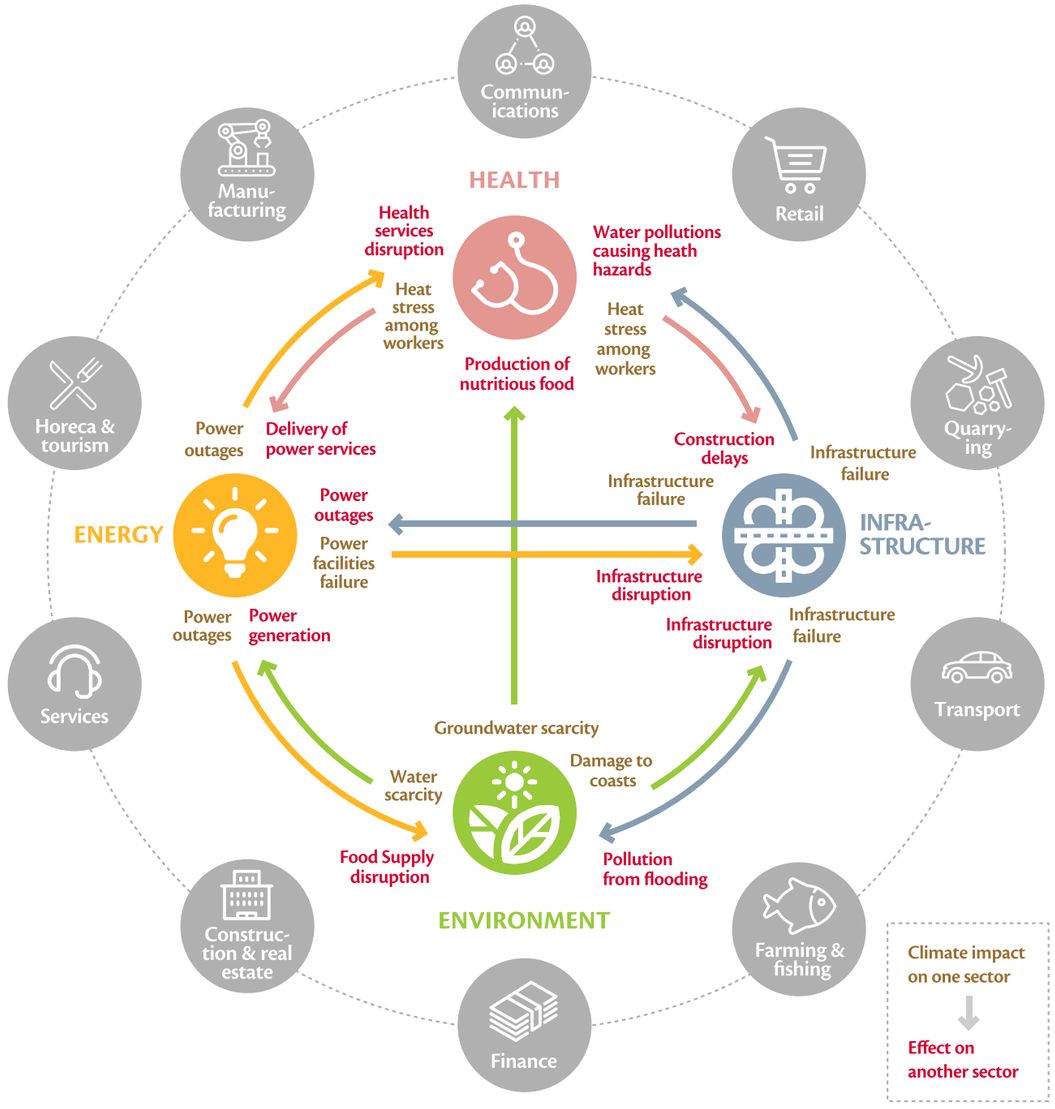
HEALTH	**Reduced productivity of outdoor workers due to heat stress**	Given the magnitude of the construction sector and the large number of outdoor workers, the potential socio-economic impacts of heat stress need to be addressed.
ENERGY	**Efficiency losses of power plants** **Reduced power output due to warmer cooling water** **Deterioration of power facilities**	Climate change puts the reliability of the power system at risk as extreme weather events may push the operational capacity of power facilities and equipment beyond thresholds. Increased maintenance cost is also expected for ageing facilities not built to meet rising temperature and extreme events.
INFRA-STRUCTURE	**Damage to coastal and offshore infrastructure** **Increased infrastructure maintenance cost** **Loss of business opportunities due to transport disruptions** **Reduced reliability of transport infrastructure and buildings**	Since most of the population and the infrastructure are located within a short distance from the sea, the damage to coastal and offshore infrastructure can be significant. It is critical to invest in and design climate-resilient infrastructure as early as possible given its long service lifetime.
ENVIRONMENT	**Coral bleaching** **Loss of wetlands**	While human-induced pressures are already putting the natural assets under strain, climate change may intensify the risks affecting the functioning of ecosystems in the UAE's hyper-arid environment.

Priority climate risks for the UAE

Cross-sectoral linkages of risks

Climate change is a "threat multiplier". A particular climate event may affect more than one sector, or a climate change impact on one sector may affect or aggravate the effects in other sectors. Floods, for example, may not only damage infrastructure, but also disrupt power services and business continuity, disturb ecosystems, and pollute water bodies, which may further cause disease outbreaks. Moreover, power outages or damage to power cables may halt the operations of transport infrastructure and disrupt the provision of healthcare services.

Sectoral climate risks may also substantially affect sectors other than the four key sectors, including financial services, manufacturing, retail, and tourism. Understanding the cross-sectoral relationships of climate risks is crucial to identify the most appropriate measures and avoid unintended consequences.



Cross-sectoral linkages of climate risks

4. How is the UAE addressing climate risks?

Before designing the measures to address the priority sectoral risks, it is important to recognize the existing relevant efforts at both national and local levels – even though they may not be specifically targeted at climate change adaptation – and consider how they can be enhanced to better address the need for tackling the risks.

In fact, the UAE, as a pioneering country that promotes greening of the economy, has already been taking significant steps to reduce the identified climate risks through high-profile projects in renewable energy, energy efficiency, green buildings, sustainable transport, and eco-cities.* Below are examples of notable initiatives relevant to adaptation, including both hard (physical) and soft (non-physical) measures.

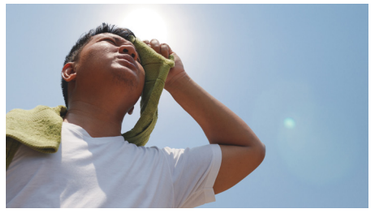
HEALTH

Mid-day break policy

The Ministry of Human Resources and Emiratisation (MoHRE) issued a ministerial decree in 2005 that requires employers to provide outdoor workers with a break between 12:30-15:00 during the peak summer to avoid heat-related illnesses.

Safety in Heat program

The Department of Health – Abu Dhabi (DoH) launched this awareness campaign in 2009 that advises employers to implement measures to protect workers from the summer heat to prevent heat-related illnesses and the resulting productivity loss.



ENERGY

Smart meters

Smart meters allow utilities to better control potential power outages during peak hours and unexpected events. The Dubai Electricity and Water Authority (DEWA) and the Federal Electricity and Water Authority (FEWA) aim to install 1.2 million and 200,000 smart meters respectively by 2020.

District cooling

District cooling systems are widespread in Abu Dhabi and Dubai, representing almost 15% of cooling in the UAE in 2015. The technology is an effective means to reduce carbon emissions as it is estimated to consume 50% less energy compared to the conventional air-conditioning.

* For details about the UAE's climate change action, see MOCCAE's publications, *United Arab Emirates: A global partner in addressing climate change* and *UAE State of Green Economy Reports*, available from www.moccae.gov.ae.

INFRA-STRUCTURE

Seawalls

Abu Dhabi developed the *Plan Maritime 2030* in 2014 as a consolidated planning framework that provides strategic guidance on coastal and marine development. This includes the construction of seawalls and other longitudinal shoreline infrastructure to respond to stronger storm surges.

Early warning system

In March 2018, NCEMA launched the National Early Warning System. It includes an advanced electronic system that allows sending warning messages to the public through smart phones during extreme events.

ENVIRONMENT

Marine protected areas

The designation of marine protected areas (MPAs) plays a critical role in building climate resilience by reducing pollution, overfishing, and habitat loss. The UAE's MPAs already cover over 12% of the territorial waters.

National Blue Carbon Project

MOCCAE and AGEDI assessed the capacity of mangroves, salt marshes, seagrass meadows, and algal mats as carbon storage and barriers for sea level rise. The results highlighted that the blue carbon ecosystem in the UAE holds substantial carbon stocks and its conservation and restoration will also bring recreational benefits.

Examples of adaptation-related measures in the UAE

Climate adaptation has been a part of the UAE's culture and way of life

Adapting to climatic conditions is not new to the UAE. For centuries, Emirati people have coped with the challenges and risks brought by the arid landscape through simple yet effective adaptation strategies. The Bedouin tent protected them from the heat, cold, and dust owing to its cooling effect in the summer and heating effect in the winter. The wind tower also served as an effective cooling and ventilation system for houses. This traditional form of architecture is now being re-integrated into the design of modern buildings. For example, Masdar City in Abu Dhabi is experimenting with a big wind tower for cooling the outdoor space, applying this concept.

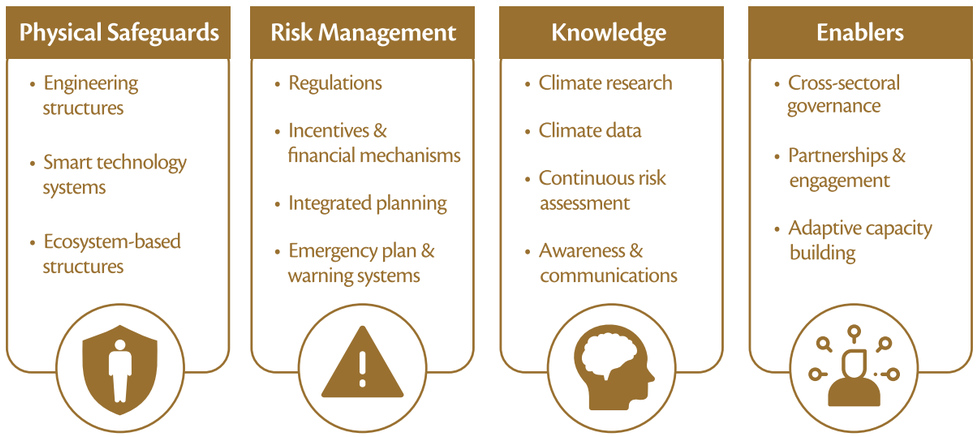
< Traditional wind tower in Al Fahidi, Dubai

Modern wind tower in Masdar City, Abu Dhabi >

5. What is the next step for advancing adaptation?

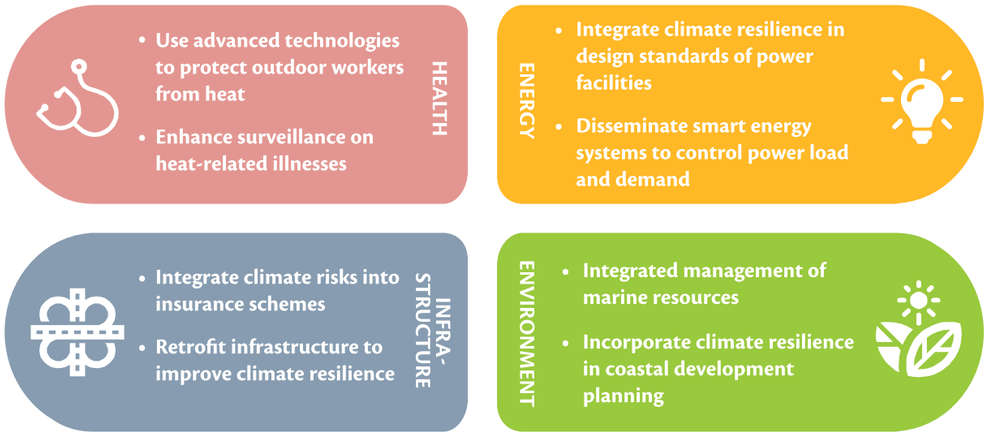
Identifying new actions

The existing measures relevant to climate change adaptation provide a foundation for the UAE to address the priority risks identified through the risk assessment exercise. In addition to refocusing and enhancing the current efforts, a set of additional policies and initiatives also need to be designed and implemented where required to manage the prioritized risks. The figure below illustrates the four areas for adaptation actions.



Four areas of climate change adaptation measures

The four areas of adaptation measures are further divided into specific categories. This taxonomy can be used to take stock of current policies, identify gaps, and develop additional measures. Below are examples of potential measures to respond to the priority risks of the four key sectors.



Examples of potential adaptation measures for the UAE

Turning risks into opportunities

The UAE is well positioned to take advantage of transforming climate risks into new opportunities, building on its transformation toward a green economy under the *UAE Green Agenda 2030* which reinforces the *Climate Plan*. For example, the country's proactive investment in large-scale solar power projects, green buildings, and sustainable cities has already resulted in new business and employment opportunities. The strengthening of the linkage between climate change adaptation and the third pillar of the *Climate Plan* – private sector-driven innovative economic diversification – provides further growth opportunities while fostering innovation in lowering emissions, raising resource efficiency, and building adaptive capacity to climate-related impacts.

Government	Industry	General Public
• New engines of growth	• Business continuity	• Better access to climate information
• Green jobs	• Cost savings	• Acquisition of green skills and jobs
• Trade opportunities from environmental goods and services	• Competitive advantage	• Protection from natural disasters
• Eco-tourism	• New investment and finance opportunities	• Enhanced health and quality of life
• Climate diplomacy	• Reduced risks	• Entrepreneurship opportunities
	• Public-private partnerships	

Opportunities from advancing climate change adaptation

Way forward

The climate change adaptation measures that have been proposed thus far will be further analyzed and prioritized in the subsequent phase of the National Climate Change Adaptation Program, in terms of their importance, cost, feasibility, practicality, and impact. This process will include the identification of a lead entity, who will further elaborate each prioritized measure with a roadmap, and will subsequently coordinate its implementation with relevant stakeholders, based on the existing capacity and expertise.

The status of climate risks and the implementation of adaptation measures need to be regularly monitored and evaluated for continuous improvement. Timely updates of risk assessments will be required to accommodate new knowledge and to make sure that risk prioritization and measures continue to be relevant.

Overall, the success of climate actions lies in the active engagement of all relevant stakeholders – national and the local entities, business and industry, academia, and the general public – to work together for the common goal of mitigating climate risks and strengthening climate resilience.

Climate change adaptation policy cycle

For further information or feedback:

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